

Figure 1:

Amino acid sequences of Cpn60 and Cpn10:

SEQ ID No 1: Cpn10 (encoded by nucleotides pos. 458-751 of Figure 2):

MKIRPLHDRIVRRKEEETATAGGIILPGAAAEEKPNQGVVISVGTGRILDNGSVQALA
VNEGDDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 2: Cpn60 (encoded by nucleotides pos. 800-2446 of Figure 2):

MAAKDVLFGDSARAKMLGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDGTTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELVDVVEGMQFDRGYLSPYFINNQEKMTEVEMENPLILLVDKKI
DNLQELLPILENAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGAEGSVVVDVKVSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

Figure 2:

SEQ ID No 3: DNA coding for Cpn60 and Cpn10:

Cpn10, pos. 458-751

Cpn60, pos. 800-2446

atcaaaaaatgcagcaaggacagattcctgccaagaattagcagaaggttctgttagcactggccggcgtttattattaacgccgg
gttttgtcaactgatgcgcgtgggtttacattactcgccccgcgcgcgtaaagcggtggccataagggtattgcatttttacccctc
gcatgatgactgcaagcagcttcaagcgacggtagtttcaggaaggctcgtaaagatgtacattgcacactgactgcaaaagca
gtcatgaaaaatcacaattgaaggcgaataccaaagacgataagttaggtattttcggctagccgttgaatcctagtaaaagccc

cgataaattaaccatctatTTcacagaggcaatttagcTTgttaccTTattgatcctaatactggatccaacagtggagagtctagc
aatgaaaatccgtccattacatgatcgTTattgtgtcgccgtaagaagaagagaccgcaactgcgggtggattatTTacc
ggcgctcgccagaaaaaccAAatcaaggTTtatctctgtggTactggccgtattCTTgataatggTcagtgcAAGCGCTGGC
ggtaacgaaggcgatgtgtcgTTTggtaataactcaggtaaaatactatcgatcgatggtaagaattattgatTTGAATGA
aagtgataCTacggcTTtagaagCTtaattttacactcactTTTttaacctaAAatttaaggaaagatcatggctgctaaagacg
tattttggTgatagcgcacgcgcaAAatgtggtaggTgtaaacatttagccgacgcagtaagagtaccTTggaccta
aggcgtaacgtgttatagaaaaatcattggTgcaccgatcatcaccAAagatggTttctgtgcgcgtgaaatcgaaagaca
aattcgaaaacatggcgacagatggtaaggaaagtgcTTcaagccaaCgaccaagccggTgacggcacaacgacagcgactg
tactagcacaggcgattatcagcgaaggctgaaatctgtgcggctggcatgaatccaatggatCTTAAACGTGGTattgataaagctac
ggcgtgtgtgcgcattaaagaacaagctcagcTTgtggatacAAAGCAATCGCTCAGGTAGGGACAATCTGCCATGC
cgatgaaacggTggTcgTTaaattgctgaagcgatggaaaggatcggtaaAGAAGGTGTGATTACGTTGAAGAAGGCAAAGGCCTG
aagacgagCTgtgttagaaggcatgcagttcgatcggttacttgcTCCGTACTTcatcaacaaccAAAGACCGTAGTGTGA
aaatggaaaatccattaattctattggTgataagaaaattgataaccTTcaagagCTGTTGCAATTCTGAAACGTGCTAAATCAGGT
gtccattattgatcgTTgctgaagatgtgaaggccaagcactagcaacattggtagtAAACACTTGCACGGCACATTCAAGGTG
agcggtaaagccccTggTTTggcgatcgtaaaggcgatgttgcagatctggccatCTGACGGTGGTcaggTTattCTGAAGAG
ctaggatgtcttagaaactcgggatcTTCTTGGTACGGCAAGCAAGGTGTTATCGATAAAGAAACACCGTAGTGTGA
TGGCGCAGGTACTGAAGCAAGCGTAACTCGTGTGACCAGATCGTGTGCTGAAATCGAAAGCTGACTCTGATTACGACATCGAAA
GTTACAAGACCGTTGCTAAGCTTGCAGGGCGGCGTTGCCGTGATTAAGGTTGGTGCAGGGTCTGAAATGAAATGAAAGAGAAA
GACCGTGTGACGATGCACCTCATGCAACTCGCGCAGCGTTGAAGAAGGTGTTGCGGGTGGTGGTTGCTTGAATCGCGC
ACTCTTCAGTAACCGTTGGTGTGATAACGAAGATCAAACGCGGTATTGCAATTGCGACTTCGTGCGATGGAAGCTCTATCGTCAAATCG
GGGTAACCGCAGGTGCTGAAGGGTCACTGGTTGATAAAGTGAATCTGGCACAGGTGACTTGGTTAACGCCAGCACAGGTGAGT
ATGGCGATATGATTGCGATGGTATTAGCCCTGCAAAAGTCACCGCTCATCTACAGCCCGGGCTATCGCAGGTTGATG
CACAACCGAAGCCATGGTGCAGGATGCGCCTGTTGAAGAAGGCGCTGGTGTGCTGATGGCGGGCATGGTGGAAATGGCG
TATGCCCTGGCATGATGTAATCACTTGTGATTCTTGTCTGCTGAAACGACATTCTGGAGTGCAGGCTTTTGATTTGGTCA
TAAATTGAGTGTGTCTTGTGAAACGACATTCTGGAGTGCAGGCTTTTGATTTGGTCAAAAATTGAGTGTGAAATT
TGTAACTAGCTGGCTATAATGTTGAGTGCAGGCTGGCATGATCTCATGGTACTTCACCTGATTACTGCG
GCTTAAACAGTAAATAACGCAACGTAGAAACATAAGCGTATGGCATTAAATGAAGACGGCTGCAATTCAATTGAGT
GCTTAAACAGTAAATAACGCAACGTAGAAACATAAGCGTATGGCATTAAATGAAGACGGCTGCAATTCAATTGAGT

Figure 3:

SEQ ID No 4: Amino acid sequence of esterase cloned from *Oleispira antarctica* (EstRB8):

EstRB8 (encoded by nucleotides 1145 to 2143 Frame 2 of Figure 4) 333 aa

MKNTLKSSSRFLKQLGTGALISSLFFGGCTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSAKDWNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHAGNSMGAISAIYSLSHPEKVKSL
TLIDAAGVDGDESEYYKVLAEGKNPLIATDEASFYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAA AFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 4:

SEQ ID No 5: DNA fragment from plasmid pBK1Est coding for esterase of *Oleispira antarctica* (EstRB8):

Nucleotide positions 1-100 correspond to reverse complement of positions 1196-1121 and 3799-3939 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene).

Positions 101-105 are *BamHI* – *Sau3A1* fusion and positions 3795-3798 are *Sau3A1-BamHI*-fusion.

acaggaaacagctatgacctt gattacgccaagctcgaaattaaccctactaaaggaaacaaaagctggagctcgccgcctgcag
gtcgacactagtggatcaacggcggtcatggtaactggctgagttcagcgtcataatgccatgcgatactggccgtcatgactgact
tcttcgtctgaccgattttctaatacgccagctctttatttctgaacggcaactgtatgtatgtttttactaaccggcttttaggcatgg
taaactctcgatattcaaattttactgttcatattacaatcatagtcaggctagaggccaaaattgcagctgatattcaccttattattc
taagcattattacactcatcgccgttattaaattgtctaaataaaaatcccgtagcggaaaaattcagcaaatacgccaaagaaaacga
ttggcaatccaagaattcatcgattttgatgatgacattaagcaggcaaacttggcctattaaactacagtcaaaatgcaatttttagacat
ctcattcaagcaactgacgaacactatggcttagcgtaaagaccccttgactgtcgagcgttagaacccctcaggtattcacaatagcagtctt
attttatttaccctcgactaaagactgaattcaataacctacacattgcttaagtcgacatattcaagataaagatgccttactgacatca
gtcaccaacaatcaaaacaccaatccaatcgcaaaaactcataaaactagccatcaccatccaaaagcgttcaaaaatgaa
acgagcacgtcacaaaaatcaatttacgctaaccgaggtaacttgcgttgcacgttttgcacgtttgtccactaatgaaagaga
aaagtcgttaattcactggctttggcgatccgcacccctcacatagaaatttagtaatggcatgctactggcctttaaaaagaatcagttaatt
gaagaaacctcgcttatctcagccattaccgcttagccgaattgcgttatcctcagccatgattaaactgacgccaattataagac
atactaattaaactcccttaattgagaagaataatgaaaaacacactcaaattctcatcagtttagtctgaaacaactcggcaccgac
gctctgattatctccagttgttctcggtggcaccacaacacaagataatttatacacaggggttatgtcttgcgagagac
gctggcctagaagttaaaacagccctgcccggtagcgtcaattttacttatatggaacgccaaggcagtgacaaagataatgcgaaag

cgttattttattacacgggttctgctgataaagataactggatttttaccaaagaattcgataaaaatcatgttatcgctgtcgatttgcgggacatggcgattcagaacaattattaacgactgattacggctcataaaacaagccgagcgtagatcttcttatctggcttagggtaactcattcacatcgccgtaattcaatgggggggctatcagcgaatctacagtttagtgcacccagagaaagttaaaagtcttacattgatcgatgcagcagggtcgatggcgatactgaaagcgaatactacaaagtttggcagaaggtaagaatccttaattgcaactgatgaagcaagtttgaataccgcatgggttcaccatgactcagcccttccaccttggccactaagaccccttattacgtaaaacgctagcccgccgagatcaataacaaaattttccgatatgctgaaaaccaaagaacgctttaggaatgactaactttcaacagaaaattgaaagtgaaaatggctcaacatccattgccaacactgattatgtggggcaaagaagatcgcgttgcacgtatccgcagcagccgcttcaaaaaaataattccacaagcaactgtcatatttccctgaagtaggcacctatggtagaaattccctagtgaaagcgctaaagttttgaagagtttgccttattaaataagagcacataatcatgactgacttataaacagccaagttaaatgttgcgtttatttatgcccacatttcaacgaccaagctcgccgtaaaatcgcaagtgggttgcatttcatcaacagcaacaaacgtgaaatccccgtaatcgcatttctgattatcaaaatacatacttccaccagcatattacaacttcaactttaaactcgcccccacctctataacactggcagtcattcgacaatgttgcgggaaacaggatgcttaaaatcgattcgactcactgctgacggttacgatgcttgcgagaaaacgagtcgctgcaataaaaaagaaacctcatccatccactgcattgcagtgccaccgaataacgtatcatgatgatttgtctcgaaataccgctttagaatagtggtttgcgatcgccgttcgcgcaataatattctctgctaagagttgcggatggcatacataactcgcttgcgatggattataataataatagttacagttactgagggtctgagaactctaatacctctgaaactttgaggcccttagagagaaaaagaccaatgtgataatattcatctgcatgagagcttcatgaaagcctgtgcattaaatcatcattatatttattcatctttaattgaaataatccaaatatttcataatataatttcacactacccttatctcaactgacttcccgccataggcgcaaacaatcaacgcaagttcacaataaagcggttgcgtcaacacatgccctagcgtctaaagtagcacgcacaacactggccagtcgtacttagcccttgcgatcgacgagacgaaacaaagcgcttacccatccatctgcaattaaacgatgcacatcgatctaaacccgcattcaagcgctcattaaaacgcaccactggcaagaagttctacctgcactgaccaatatgcaagcggccggaaagagactgcgttgcattgatcgatcaagaagaaggagcagcagaaagagggaaacaaatcaaaaagaggagcaatcaaaataaaacgagttattgaggatttaattttaaacaggatattaaaccctctctgtagtaacaaacatgactgtatttacacaaaataaaatagaggataccatgtcaaaacatctggttgaagtaccaaagattgaagtattaaaccgtcaatggaaaactgcctgcagcaaccatggcattcaattacagaaattggcgatgattatctactggcacaatgccagcagatgcaccccttgcagccaaatggactgattatggcggtcaatgtattgcgttgcagaaacactgggcagcatggcagcatggcagactgctgtattaaattgtctcaagaatattgttggcetaaaatcaacgccaaccacatacgcgggttcgttccggcatagtgcactggcacaagcgtactacacaaaagggaaacccctccatgttggggaaattcgcatcgtaacgatccaaagaattcaaaaagcttctcgagagttacttctagagcggcccgcccattcgattttccacccgggtgggtaccaggttaagtgtacccaaattgcctatagtgactgatcgattacaattcactggccgtcgattttac

Figure 5:

Amino acid sequences expressed from vector pBK1CpnEst: - the co-expression of fragments encoding native chaperonines with the esterase gene (EstRB8), all from *Oleispira antarctica*

SEQ ID No 6: cpn10 (nucleotides 113 to 403: Frame 2 of Figure 6) 97 aa:

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEEKPNQGVVISVGTGRILDNGSVQALA
VNEGDDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 7: cpn60 (nucleotides 455 to 2098: Frame 2 of Figure 6) 548 aa:

MAAKDVLFGDSARAKMLGVNILADAVRVTLGPKGRNVVIEKSGFAGPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDGTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELVDVVEGMQFDRGYLSFYFINNQEKMTEVEMENPLILLVDKKI
DNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVNNLRGTFKVAAVKAPGFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTSVDYDIEKLQERVAKLAGGVAIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGAEGSVVVDVKVSGTGSFGFNASTGEYGDMIAMGILDPAKVTSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

SEQ ID No 8: estRB8 (nucleotides 2579 to 3577: Frame 2 of Figure 6) 333 aa:

MKNTLKSSSRFLKQLGTGALISSLFFGGCTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSAKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHAGNSMGGAIASIYSLSHPEKVKSL
TLIDAAGVDGDESEYYKVLAEGKNPLIATDEASFYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAFAKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 6:

SEQ ID No 9: pBK1CpnEst: - the fusion of native chaperonine-coding fragments with esterase of *Oleispira antarctica* (EstRB8)

The DNA fragment coding for Cpn10 and Cpn60 is flanked by *SacI* site (pos. 69-75) and *SalI* site (encoded by pos. 2138-2143 of Figure 7):

Nucleotide positions 1-75 correspond to reverse complement of positions 1196-1121 and positions 5233-5273 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene)

Small letters – the Cpn10-Cpn60 encoding fragment,

Capital italics – fragments of vector pBK-CMV

Capital letters – fragment coding for EstRB8 from plasmid pBK1Est

ACAGGAAACAGCTATGACCTTGATTACGCCAAGCTCGAAATTAACCCTCACTAAAGGGA
*ACAAAAGCTGGAGCTC*ctaatactggatccaacagttggagagtcttagcaaatgaaaatccgtccattacatgatcgatt
gttggccgtaaagaagaagagaccgcaactgcgggtggattatttaccggcgctgcccagaaaaaccataagggtgtt
tatctctgtgggtactggccgtattctgataatgggtcagtgc^aagcgctggcggttaacgaaggcgatgtgcgtttggtaataactc
aggtaaaaactatcgatatcgatgtgaagaattattgattttgaatgaaagtgtatctacggcg^ttttagaagcttaatttacactca
ctttttat^ttaac^tacaaaatttaaggaaagatcatggctgctaaagacgtattattggatagcgcacgcgcaaaaatgtggtaggt
gtaaacattttagccgacgc^aacttggacctaaggcgtaacgtttagatagaaaaatcattggcaccgc^tatcac
caaagatgggtttctgtgcgcgtgaaatcgaattgaaagacaaaatcgaaaacatggcgacagatggtaaggagttgc^ttc
agccaaacgaccaagccggtgacggcacaacgc^aacgcgactgtactgcacaggcgattatcagcgaaggctgaaatctgtgcgg
ctggcatgaatccaatggatcttaacgtggattgataaagctacggctgctgttgtgcgcattaaagaacaagctcagc^ttcgc^ttg
gataaaaaagcaatcgctcaggtagggacaatctgc^aatgcgc^tatgaaacggttggcg^ttaattgtgaagcgatggaaaaagt
cggttaaaaagggtgtgattaccgttgaagaaggaaaggcc^ttaagacg^acgctgtatgttgc^tgtagaaggcatgc^tgc^tgc^ttt
acttgtctccgtacttcatcaacaaccaagaaaaatgaccgt^aagatggaaatccattaattctattggatagaaaaattgataac
cttcaagagctgttgc^aattcttgaaacacgtcgctaaatcaggtcg^tatttgc^tgttgc^tgtaagatgttgc^tgaaaggcaagcactagc
aacattggtagtaaacaacttgc^tgc^tggcacattcaagg^tgc^tgc^ttaaagccc^tgg^tttggcgatcgtgtaaagcgatgtgc^t
agatcttgc^tcatctgc^tgc^tgg^tggc^tagg^tatttgc^tgaagagctaggatgttgc^ttttagaaactgc^tggatc^tttc^tttgg^tacggcaag
caagg^tttatcgataaaagaaaaacccgtgattgtgatggcg^tcagg^tactgaagcaagcgtaatactcg^tgttgc^taccagatccgtgc^t
gaaatcgaagctcgacttctgattacgacatcgaaaagttacaagaacgcgttgc^ttaagcttgc^tggggccgttgccgtgattaagg^t

ggtgccgggtctgaaatggaaatgaaagagaagaagaccgtgtgacgatgcacttcatgcaactcgccagcggtaagaagggttggttgcgggtgggtgttgcattcgccactcttcagtaaccgttgggtgataacgaagatcaaaacgtcggtattgcattgcacttcgtcgatgaaagctcctatccgtcaaatcgccggtaacgcaggtctgaaagggtcagtggttgtataaagtgaaatctggcacaggtagcttggtttaacgcccagcacaggtaggtatggcgatattgcgtgggttttagaccctgcaaaagtcacgcgttactctacaagccgcggcgttatcgccaggtagtgcgtatcacaaccgaagccatgggtgcggatgcgcctgtgaagaaggcgctgggttatgcctgatatggcggcatgggtgaaatggcggatgcctggcatgtatacttgcattgtcctgatctgcgttaccgtGTCGACATATTCAAGATAAAGATGCCTTCACTGACATCAGTCACCAACAATCAATC
AAACACCAATACCAATCGCAAAACTCATAAAAGTAGCCGATCACCAAAATCCC
AAAGCGTTCAAAATGAAACGAGCACGTCACACAAAATCAATTATACGCTAAC
GAACCAGGTCAAACCTATCGTTTTGAGCACGTTGTTCCACTAATGAAAGAG
AAAAGTCGTTAATTCACTGGCTTGGCGTATCCGCACCTCACATAGAAATTAGT
AATGGCATGCTACTGGCCTTAAAAAGAATCAGTTAATTGAAGAAACCTCGCTTA
TCTCAGCCATTACCGCTGTAGCCGAATTGCGCTTATCCTCAGCCATGATTAAACT
GACGCCAATTAATATAAGACACTAATTAAACTCCCTTAATTGAGAAGAATA
ATGAAAAACACACTCAAATCCTCATCACGTTTAGTCTGAAACAAACTCGGCACCG
GCGCTCTGATTATCTCCAGTTGTTCTCGGTGGTGCACCACAACACAAGAT
AATTTATACACAGGGTTATGTCCTTGCAGAGAGACAGCGCTGGCTAGAAGTTA
AAACAGCCTCTGCCGGTGACGTCAATCTTACTTATGGAACGCCAAGGCAGTGA
CAAAGATAATGCCAAAGCGTTATTTATTACACGGTTCTGCTGATAAAAGAT
AACTGGATTCTTTACCAAAGAATTGATGAAAAATATCATGTTATCGCTGTCGA
TTAGCGGGACATGGCGATTCAAGAACATTAAACGACTGATTACGGTCTCATA
AAACAAGCCAGCGTTAGATATCTTCTATCTGGCTAGGGTTAACTCATTCA
CATCGCCGGTAATTCAATGGGGGGCTATCAGCGCAATCTACAGTTGAGTCAC
CCAGAGAAAGTTAAAGTCTTACATTGATGTCAGCAGCGTGTGATGGCGATA
CTGAAAGCGAATACTACAAAGTTGGCAGAAGGTAAAGAACCTTTAATTGCAAC
TGATGAAGCAAGTTGAATACCGCATGGTTTACCATGACTCAGCCTCCTTCC
TACCTTGGCCACTAAGACCTTCTTATTACGTAACCGCTAGCCGTGCCGAGATC
AATAACAAAATTTTCCGATATGCTGAAAACCAAAGAACGTTAGGAATGACTA
ACTTCAACAGAAAATTGAAGTGAAGTAAAATGGCTCAACATCCATTGCCAACACTGAT
TATGTGGGGCAAAGAAGATCGCGTTCTGACGTATCCGACAGCGCCCTCAAA
AAAATAATTCCACAAGCAACTGTTCATATTTCTGAAGTAGGCCACCTACCTAT
GGTAGAAATTCTAGTGAAAGCGCTAAAGTTATGAAGAGTTTGTCTCTATTAA
AATAAGAGCACATAATCATGACTGACTTATAAACAGCCAAGCATTAAAATGCTT
GGCTGTTATTTAATGCCAAATTATTCAACGACCAAGCTCGGGTAAAATCG

CAGTGGGTTCTGTTCATCACACAGCAACAAACGTGAAATACCCGTAATCGC
ATTTTCTGATTATCAAAATACATACTTCCACCAGCATATTAACTCAACTTTA
AACTCGTCCGCCCTACCTCTATAACACTGGCAGTCAATTGACAATGGTACCTGC
GGGAACAGGATGCTAAAATCGATTGATCACTGCTGACGGTACGATGCTTGT
CGAGAAAAACGAGTCGCTGCAATAAAAGAAACCTCATCCACTGCATTGCA
GTGCCACCGAATAACGTATCATGATGATTGTTGCTCTGAAATACCGCTTAGA
AATAGTGGTTTGATACCGCCTTCGCTGCGCAATAATATCTTCTGCTAAGAG
TTGCGGATGGCATAACATAACTCGCTGATTAAGATTAATAATAAAAGTTAAC
GTATATTGAAC TGAGGGTCTGAAGAACTCTAATACCTCTGAAGAACTTGAGGCC
GCTAGAGAGAAAAGACCA GTGATAATATTCATCTGCCATGAGAGCTTACATG
AAAGCCTGTGCTAAAATCAATCATTATTTATTCACTTTAATTGAAATAATAC
CAATATATTCATATATAATTCACACTACCCTATCTCACTAGACTCCCCGCGCA
TAGGCGCAAACAATCAACGCAAGTTACAATAAGCGGTCGCTGCAACACATG
CCCTAGCGTCTAAAGTAGCACGCACAACACTGGCCAGTCGTACTAGCCCCTTGC
GATTGTCAGACGAGCAACAAGCGCTATTAAACTACCTAAATTCTAACCCACC
ACCATTGGTTCTTCCACAAACTCAAAAAACTCGTCAAATCCGCTTGCAATTAA
ACCGATGACATAGATCTAATCGATTATCAAACCCGATTCAAGCGCTATTAAA
AACGCACCACTGGCAAGAAGTTCTACCTGCACTGACCAATATGCAAGCGGCC
GGAAGAGCTGCCTTGATCGATCAAGAAGAAGGGAGCAGCAAAGAGGAAAACA
ATCAAAAAGAGGAGAGCAATCAAATAAAACGAGTTATTGAGGATTAAATTAA
AAACAGGTATATTAATACCCCTCTCGTAGTAAACAATGACTGTATTACACAAA
AATAAAATAGAGGTATACCATGTCAAACATCTGGTTGAAGTACCAAAGATTGAAG
TATTAAACCGTCAAATGGAAAATCTGCCTGCAGCAACTTAGGCATTCAAATTAC
AGAAATTGGCGATGATTATATCACTGGCACAATGCCAGCAGATGCACGTACCTC
CAGCCAATGGGACTGATTCATGGCGGCTCAAATGTATTGCTGGCAGAAACACTGG
GCAGCATGGCAGCTAACTGCTGTATTAATTGCTCAAGAATATTGTGTTGCCA
AGAAATTAAACGCCAACACATACGCGGTGTTCGTCCGGCATAGTACTGGCACA
GCAACGCTAGTACACAAAGGAAGAACCTCCCAGATTGGAAATTGCACTCGTTA
ACGATCCAAGAATTCAAAAAGCTCTCGAGAGTACTTCTAGAGCGGCCGCGGGCCA
TCGATTTCACCCGGGTGGGTACCGAGTAAGTGTACCCAATTGCCCTATAGTGAGT
CGTATTACAATTCACTGGCGTCGTTTAC

Figure 7:

Amino acid sequences expressed from vector pBK1CpnSREst: - the co-expression of the stabilized single ring mutant chaperonin with the esterase gene (EstRB8) from *Oleispira antarctica* (cpn10::stabilized single ring mutant

Glu461Ala/Ser463Ala/Val464Ala/Glu460Ala/Ser462Ala/Val463Ala::est)

SEQ ID No 10: cpn10 (nucleotides 113 to 403: Frame 2 of Figure 8) 97 aa:

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEPNQGVVISVGTGRILDNGSVQALA
VNEGDDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

Below – ***Capital bold letters*** are the mutations introduced

SEQ ID No 11: stabilized single ring mutant of cpn60 (nucleotides 455 to 2098: Frame 2 of Figure 8) 548 aa:

MAAKDVLFGDSARAKMLVGVNILADA
RVTLGPKGRNVVIEKSF
GAPIITKDGVSVA
REIELKDKFENMGAQMVK
EVASQANDQAGD
GTTATVLAQAI
IISEGLK
SVAAGMNP
MDLKRGIDK
ATAAVVAA
IKEQA
QPCLDT
KAIAQV
GTISAN
ADETV
GRLIA
EAMEK
VKG
KEGVIT
VEEGKG
LEDEL
DVVEGM
QFDRG
YLS
PYFINN
QEKM
TVE
MENPL
LVDKK
I
DNLQ
ELL
PILE
NA
VAKSG
RPLL
LIV
AED
VEG
QAL
ATLV
VNNL
RGTF
KVA
AVK
APG
FGDR
RKAM
LQDL
AILT
GGQV
ISEEL
GMS
LETAD
PSSL
GTASK
V
VIDK
ENTV
IVDG
AGTE
ASV
NTRV
DQIRAE
IESST
SDYDIE
KLQ
ERVA
KLAG
GVAV
IKVG
GAG
SEM
MEM
KEKK
DRV
DDA
LHAT
RAVE
EGVV
AGGG
VALIR
ALSS
VT
VVG
DNED
QNV
GIAL
AL
RAME
API
RQI
AGN
AGA
AGA
AVV
DKV
KSG
TGS
FGFN
AST
GEY
GDM
IAM
GILD
PAK
V
TRSS
LQAA
ASI
AGL
MIT
TEAM
V
ADAP
VEEG
AGG
MPDM
GG
GG
GG
MPG
MM

SEQ ID No 12: EstRB8 (nucleotides 2579 to 3577: Frame 2 of Figure 8) 333 aa:

MKNTLKSSSRFSLKQLGTGALI
SSLFFGGCTTQQDNLYTG
VMSLARDSAGLEV
KTA
SAGDVNLTYMERQG
SDKDNA
ESVILLHGFSAD
KDNWILFT
KEFDE
KYH
VIA
V
DLAG
HGDSE
QLLTT
DYGLIK
QAERL
DIFLS
GLGV
NSFH
IAGNS
MGGA
ISAI
YSL
SHPE
KVSL

TLIDAAGVGDTESEYYKVLAEGKNPLIATDEASFYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVL
VSAAAFAKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 8:

SEQ ID No 13: DNA sequence of vector pBK1CpnSREst: the expression cassette for the co-expression of the stabilized single ring mutant chaperonin with the esterase gene (EstRB8) from *Oleispira antarctica* (cpn10::stabilized single ring mutant

Glu461Ala/Ser463Ala/Val464AlaGlu460Ala/Ser462Ala/Val463Ala::est)

Nucleotide positions 1-75 correspond to reverse complement of positions 1196-1121 and positions 5233-5273 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene)

DNA fragment coding for Cpn10 and Cpn60 is flanked by *SacI* site (pos. 69-75) and *SalI* site (pos. 2138-2143).

In the DNA sequence:

Small letters – the Cpn10-Cpn60 coding fragment,

Capital italics – fragments of vector

Capital letters – fragment coding for EstRB8 from plasmid pBK1Est

Capital bold letters = introduced mutations

TGATGAAGCAAGTTGAATACCGCATGGGTTCACCATGACTCAGCCTCCTTCC
TACCTTGGCCACTAAGACCTCTTATTACGTAAAACGCTAGCCGTGCCGAGATC
AATAACAAAATTTTCCGATATGCTGAAAACCAAAGAACGTTAGGAATGACTA
ACTTCAACAGAAAATTGAAGTGAAAGATGGCTCAACATCCATTGCCAACACTGAT
TATGTGGGGCAAAGAAGATCGCGTCTGACGTATCCGCAGCAGCGCCTCAAA
AAAATAATTCCACAAGCAACTGTTCATTTTCTGAAGTAGGCCACCTACCTAT
GGTAGAAATTCTAGTGAAAGCGCTAAAGTTATGAAGAGTTTGTCTCTATTAA
AATAAGAGCACATAATCATGACTGACTTATAAACAGCCAAGCATTAAAATGCTT
GGCTGTTATTTAATGCCAAATTATTCAACGACCAAGCTCTCGGGTAAAATCG
CAGTGGTTCTTGTTCATCAACAGCAACAAACGTGAAATACCCGTAATCGC
ATTTTCTGATTATCAAAATACATACTTCCACCAGCATATTAACTCAACTTTA
AACTCGTCCGCCCTACCTCTATAACACTGGCAGTCAATTGACAATGGTACCTGC
GGGAACAGGATGCTAAAATCGATTGATCACTGCTGACGGTTACGATGCTTGT
CGAGAAAAACGAGTCGCTGCAATAAAAGAAACCTCATCCACTGCATTGCA
GTGCCACCGAATAACGTATCATGATGATTGTTCTGGAAATACCGCTTCTAGA
AATAGTGGTTTTGATACCGCTTCTGCTGCGAATAATATCTCTGCTAAGAG
TTGCGGATGGCATAACATAACTCGCTTGATTAAGATTAATAATAATAGTTAAC
GTATATTGAACTGAGGGTCTGAAGAACTCTAATACCTCTGAAGAAACTTGAGGCC
GCTAGAGAGAAAAGACCAAGTGTATAATTTCATCTGCCATGAGAGCTTATCATG
AAAGCCTGTGCTAAAATCAATCATTATATTATTCATCTTAAATTGAAATAATAC
CAATATATTCATATATAATTCACACTACCCCTATCTCACTAGACTTCCCGCGCA
TAGGCGCAAACAATCAACGCAAGTTACAATAAAGCGGTCGCTGCAACACATG
CCCTAGCGTCTAAAGTAGCACGCACAACACTGCCAGTCGTACTAGCCCTTGC
GATTGTCAGACGAGCAACAAGCGCTATTAAACTACCTAAATTCTAACCCACC
ACCATTGGTTCTTCCACAAACTCAAAAAACTCGTCAAATCCGCTGCAATTAA
ACGCGATGACATAGATCTAATCGATTATCAAACCCGATTCAAGCGCTATTAAA
AACGCACCACTGGCAAGAAGTTCTACCTGCACTGACCAATATGCAAGCGGCC
GGAAGAGCTGCCCTTGATCGATCAAGAAGAAGGGAGCAGCAAAGAGGAAAACA
ATCAAAAAGAGGGAGAGCAATCAAATAAAACGAGTTATTGAGGATTAAATTAA
AAACAGGTATATTAAATACCCCTCTCGTAGTAAACAATGACTGTATTACACAAA
AATAAAATAGAGGTATACCATGTCAAACATCTGGTTGAAGTACCAAAGATTGAAG
TATTAAACCGTCAAATGGAAAATCTGCCTGCAGCAACTTAGGCATTCAAATTAC
AGAAATTGGCGATGATTATATCACTGGCACAATGCCAGCAGATGCACGTACCTC
CAGCCAATGGGACTGATTGATGGCGGCTCAAATGTATTGCTGGCAGAAACACTGG

GCAGCATGGCAGCTAACTGCTGTATTAATTGTCTCAAGAATATTGTGTTGCCA
AGAAATTAACGCCAACACATACGCGGTGTTCGTCCGGCATAGTGACTGGCACA
GCAACGCTAGTACACAAAGGAAGAACCTCCAGATTGGAAATTCGCATCGTTA
ACGATCCAAGAATTCAAAAAGCTTCTCGAGAGTACTTCTAGAGCGGCCGCGGGCCA
TCGATTTCCACCCGGGTGGGGTACCAGGTAAGTGTACCCAATTGCCCTATAGTGAGT
CGTATTACAATTCACTGGCCGTCGTTTAC

Figure 9:

Amino acid sequence of the stabilized single ring mutant

Glu461Ala/Ser463Ala/Val464Ala/Glu460Ala/Ser462Ala/Val463Ala of Cpn60:

SEQ ID No 14: Cpn10 (nucleotides 458-751 of Figure 10):

MKIRPLHDRIVVRKEEETATAGGIILPGAAAEPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFHKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 15: Cpn60 (nucleotides 458-751 of Figure 10):

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPGRNVVIEKSFGAPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDTTTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELDVVEGMQFDRGYLSFYFINNQEKMVTMEMPLILLVDKKI
DNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTSVDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGAAGAAVVDVKVSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

Figure 10:

SEQ ID No 16: DNA sequence of the stabilized single ring mutant

~~Glu461Ala/Ser463Ala/Val464Ala~~Glu460Ala/Ser462Ala/Val463Ala:

In the DNA sequence:

Small letters – the Cpn10-Cpn60 coding fragment,

Big bold letters = introduced mutations

gggttaacgcaggcgctg**CagggGcagCgg**ttgtataaagtgaaatctggcacaggtagcttggttaacgccagcacaggtagtatggcgatatagtgcgtatgggtattttagaccctgc
aaaagtacgcgttcatcttacaagccgcggcgtatcgagggttatgatcacaaccgaagccatggtgccgtatgcgcctgttgaagaaggcgctgggtatgcctgatatggcgcatgggtggaatgg
cggtatgcctggcatgtataactttgtgattcattgcctgatctgcattaccgtgtaaaaagatcaggctcaaggctgtctctataaaa
agccgtatcttgatgagtggtgtctttctgtctgaaaacgcacattctggagtgccgctttttgtatggcataaaattcagaatattgtata
attttatgttaacttagctggctataatgttgagttccctgggtggcatgatctcatggtaacttcaacttgcattactgc
gcctttaacagtaaaataacgcacgttagaaacataataagcgtatggcattaaatgaagacggctgcatttaaltcagtc